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MEMORANDUM

To: Chris Weis, Bonnie Lavelle

From: Bill Brattin, Adrian Bradley

Date: September 8, 1999

RE: Vasquez Boulevard and I-70 Site
Draft Residential Garden Vegetable Sampling and Analysis Plan

cc: Project files

This memorandum serves as the Sampling and Analysis Plan for the residential garden vegetable sampling portion of the VBI70 Phase III Field Investigation. The Data Entry SOP is currently being updated to include instructions for entry of garden samples, but will not be available until September 13, 1999. Please feel free to contact me at (303) 292-4142 if there are any issues or points that require additional discussion.

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Basic Contract No.: SBAHQ-98-D-0002
Project No.: 96290-ARA-01
Delivery Order No.: 0008
Requisition No.: 9.5770.0175
EPA IAG No.: DW47953681

1.0 BACKGROUND AND STUDY OBJECTIVES

This document presents the sampling and analysis plan for the residential garden sampling component of the Phase III Field Investigation at the Vasquez Boulevard and Interstate 70 (VBI70) site, located in Denver, Colorado. It is intended as an addendum to the Phase III Field Investigation Project Plan, prepared by the USEPA, Region 8 with technical assistance from ISSI Consulting Group, Inc. Detailed descriptions of all aspects of the field investigation are described in the Project Plan, while this document addresses only those components that are specific to the garden sampling activities.

Although substantial data regarding the nature and extent of contamination have been collected at the site (USEPA 1998a, 1998b), additional data are required to support reliable risk assessment and remedial risk management decisions. These additional data will be collected during a set of field activities that are referred to as the Phase III Field Investigation. Data planned for collection include residential, park, and school surface soils, indoor dust, and alley soils. Other data necessary to support risk assessment are garden vegetables and co-located garden soils.

Residents may be indirectly exposed to chemicals of potential concern (COPC) in garden soil by ingestion of home-grown garden vegetables. COPCs are defined in Section 2.3. Very limited data (USEPA 1999) suggest that this may not be a significant source of concern, but the data are too limited to support reliable decisions. Consequently, the objective of this component of the Phase III Field Investigation is to:

> ***Collect sufficient numbers of home grown garden vegetables from within the study area to determine whether this is a significant exposure pathway, and, if so, determine the level in soil that is associated with unacceptable levels in garden vegetables.***

1.1 Project Description

These objectives will be accomplished by collection of environmental samples during field work to be completed in the summer and fall of 1999. This work will be performed by an USEPA contractor, with planning and oversight provided by the USEPA, Region 8, or a desgnated contractor (ISSI Consulting Group, Inc.). All work will be conducted in accord with the detailed specifications contained within this memorandum.

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2.0 DATA QUALITY OBJECTIVES AND STUDY DESIGN

Data Quality Objectives (DQOs) are statements that define the type, quality, quantity, purpose and use of data to be collected. The design of a study is closely tied to the data quality objectives, which serve as the basis for important decisions regarding key design features such as the number and location of samples to be collected, the chemical analyses to be performed, etc.

USEPA has published a number of guidance documents on the DQO process (USEPA 1994, 1996, 1998c), and this sampling plan has been developed in accord with that guidance. In brief, the DQO process follows a seven-step procedure, as follows:

- State the problem that the study is designed to address
- Identify the decisions to be made with the data obtained
- Identify the types of data inputs needed to make the decision
- Define the bounds (in space and time) of the study
- Define the decision rule which will be used to make decisions
- Define the acceptable limits on decision errors
- Optimize the design for obtaining data in an iterative fashion using information and DQOs identified in Steps 1-6

Following these seven steps helps ensure that the project plan is carefully thought out and that the data collected will provide sufficient information to support the key decisions which must be made. The following sections summarize the application of the DQO process to the design of the residential garden sampling portion of the VBI70 Phase III Field Investigation.

2.1 Data Quality Objectives

State the Problem

Vegetables grown in contaminated soil may take up chemicals from the soil and accumulate them in edible portions of the vegetable. Uptake of COPCs (arsenic and lead) from soil into vegetables can be estimated using mathematical models based on observations at other locations, but the actual level of uptake is very dependent on site-specific soil conditions. Thus, measurements of chemical levels in actual site vegetables are much more reliable than calculated predictions. However, available site-specific data (USEPA 1999) are too limited to reliably evaluate the potential health risk from this pathway.

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Decisions to Be Made

The decision to be made is whether or not ingestion of vegetables grown in contaminated soil is of potential health concern to residents, and if so, to define the concentration value in soil that leads to unacceptable levels of COPCs in garden vegetables.

Types of Input Needed

The basic approach for estimating exposure from garden vegetables is to determine the relationship between the concentration of a chemical in soil and the concentration in a vegetable grown in that soil. This is done by obtaining "paired" data on contaminant levels in garden soil and vegetables grown in that soil (i.e., both measurements are from the same property), and fitting the data to an appropriate equation (linear or non-linear) using computer-based regression techniques. Thus, the inputs needed to establish the parameters of this relationship are an adequate set of paired measurements of COPC levels in garden soil and co-located garden vegetable samples.

Bounds of the Study

Spatial

Any residence within the study area that has a vegetable garden is a candidate for sample collection, if authorization is granted. Selection of specific gardens to be sampled will be done to provide spatial representativeness (across neighborhoods), and will also be stratified to ensure a wide range in yard soil sample concentrations.

Temporal

All garden samples will be collected during the same 1999 growing season (summer and fall of 1999).

Decision Rule

The concentration of COPCs in home-grown vegetables will be calculated from measured garden soil concentrations using the best-fit equation through site-specific data. Both measured and

predicted values will be used to evaluate potential health risk to residents, using appropriate values for garden vegetable intake rates.

Acceptable Limits on Decision Errors

In keeping with standard USEPA approaches, the principal goal is to ensure that there is no more than a 5% probability that a risk estimate based on measured garden vegetable values will underestimate the true risk. This will be achieved by using upper-bound estimates of garden vegetable intake rates, coupled with 95% upper confidence limits on soil concentration values in garden areas. The probability of committing a Type II error (false negative) should be minimized by the number of samples being collected.

2.2 Study Design

Based on the data quality objectives outlined above, the key design elements of the garden vegetable sampling component of the Phase III project are summarized below.

Sample Number and Location

If possible, residences to be sampled will be selected to provide a range of spatial coverage (spanning multiple neighborhoods), and a range of soil concentrations (based on measured arsenic levels in yard soil). Specific locations will be selected after receipt of the Phase III soil sampling data, and gardens will then be stratified into three categories (high, intermediate, and low), based on the arsenic results of the residential yard soil sampling study.

Five gardens from each of the three categories will be selected randomly, then plotted on a site map to ensure spatial representativeness across the study boundaries. If the random selection produces clustering in any one area, the selected locations will be moved so that each neighborhood has at least one garden included in the sampling. The goal is to obtain garden vegetable and soil samples from at least 15 different residences. Within each location, one composite garden soil sample and one sample of each type of vegetable grown in the garden will be collected.

Vegetable Samples

In order to assess the potential human health risk associated with the ingestion of vegetables

grown on soil with elevated arsenic and lead levels, a representative sample of each type of vegetable grown in each garden will be collected. A minimum of 200 g (wet weight) is required for each analysis. Results will be reported on a dry-weight basis.

Soil Samples

Within each garden, a single composite soil sample will be collected. This will consist of a minimum of three and a maximum of eight sub-samples collected next to each plant that is sampled. Results will be reported on a dry-weight basis.

Sample Preparation

Vegetable samples will be washed with potable quality water and a vegetable brush, then rinsed with deionized water, using the Standard Operating Procedures (SOP #ISSI-VBI70-06) provided in Attachment 1. Soil samples will be homogenized, oven-dried, then sieved to <2 mm in accord with the most recent version of SOP #MK-VBI70-05 (Appendix F of the Project Plan).

2.3 Analyte List and Methods

Analyte List

Available data are sufficient to establish that the contaminants of chief human health concern at this site are arsenic and lead. Other chemicals either are not of health concern, or contribute a risk much lower than that contributed by arsenic (ISSI 1999). Thus, the analyte list for all samples collected during this project are arsenic and lead.

Analytical Method and Detection Limits

Lead and arsenic will be measured in vegetable samples by any of the following methods: ICP (EPA Method 6010B); ICP-MS (EPA Method 6020); or GFAA (EPA Method 7060, 7421), providing that project-required detection limits are achieved. Soil samples will be analyzed by X-Ray Flourescence (XRF). The project-required detection limits (MDLs and PQLs) required for each analytical methodology planned for this investigation are summarized in Table 2.1.

Table 2.1: Project-Required Detection Limits

Analyte	Garden Vegetables (dry weight)		Garden Soil (dry weight)	
	MDL	PQL	MDL	PQL
Arsenic	0.05 ppm	2 ppm	10 ppm	30 ppm
Lead	0.05 ppm	2 ppm	50 ppm	150 ppm

MDL: Minimum Detection Limit
PQL: Practical Quantitation Limit

Data Interpretation/Data Use

Data collected from this study will be used to determine if ingestion of vegetables grown within the VBI70 site poses a significant human health risk. Measured values will be used to calculate a preliminary risk estimate based on site-specific data. In addition, results of the vegetable analysis will be compared with the observed garden soil concentration of arsenic and lead at each residence, to determine the concentration value in garden soil that leads to unacceptable levels of COPCs in garden vegetables.

3.0 FIELD SAMPLING PLAN

This Field Sampling Plan (FSP) describes the methods and procedures required for implementation of field sampling activities planned as part of the garden sampling portion of the VBI70 Phase III Field Investigation including: descriptions of the sampling locations; number of samples planned for collection; sample matrices; and methods for sample collection, handling and analysis. The following sections describe collection procedures, analytical methods requirements, and detection limits for garden vegetable and soil sampling. Procedures associated with obtaining property access, waste management and disposal, and health and safety are outlined in the Project Plan.

In general, the steps required for successful implementation of this FSP include:

- Obtain a list of eligible properties for garden sampling
- Obtain property access authorization
- Collect samples (e.g., residential garden vegetables and soil)
- Submit samples under chain-of-custody for analysis
- Perform sample preparation steps
- Perform sample analysis

At each step where data are collected, data must be incorporated into the project database in an accurate and timely fashion in accord with procedures outlined in the Section 5.0 of the Project Plan. Specific data entry requirements are provided in the most recent version of SOP #ISSI-VBI70-05 (Attachment 2).

3.1 Property Access Agreements

As noted previously, all of the residences with gardens that were included in the Phase III residential yard sampling are eligible as part of this design. Written authorization to sample the garden must be granted by the property owner prior to sampling. The general process for obtaining and maintaining documentation on property access authorization is summarized in Section 3.2 of the Project Plan. Specific details for obtaining access agreements are provided in SOP #MK-VBI70-01 (Appendix F of the Project Plan).

3.2 Residential Garden Selection

As stated previously, gardens will be selected for sampling after receipt of the yard soil results, to provide a range of spatial coverage (spanning multiple neighborhoods), and a range of soil concentrations (based on measured levels in yard soil). The goal is to obtain garden vegetable and soil samples from at least 15 different residences. Within each location, one sample of each type of vegetable grown in the garden will be collected, as well as one composite sample of garden soil.

After yard soil results are received, they will be stratified into three groups (low, intermediate, high) based upon the maximum arsenic level in the yard soils for a single residence. The results within a concentration category will then be randomized and the first 5 residences will be selected for sampling. After selection, the locations of the 15 residences will be plotted on a map

(using a scheme to delineate between arsenic concentration categories) to determine if selected samples are well distributed across the site boundaries. If clustering is observed, alternative location(s) will be identified by choosing the next random sample that provides better distribution across the site.

3.3 Identification and Collection of Garden Vegetable and Soil Samples

Vegetables

Before collecting any samples, the sample location will be recorded on the site diagram. Plant types and their respective locations will be sketched on the diagram, and specific plants selected for sampling will be recorded on the diagram with a circled 'v'. Samples will be harvested as they would be in a commercial garden, cleaned of all soil adhering to the surface, and placed in a plastic ziplock bag.

Garden Soil

One composite soil sample that consists of 3-8 sub-samples will be collected from each garden. Sub-samples will be collected next to each plant that is selected for sampling, at a maximum of 6 inches from the plant being sampled. Soil sub-sample locations will be recorded on the site diagram with a circled 's'.

3.3.1 Sampling Method Requirements

All garden vegetable samples will be collected in accord with the Garden Vegetable Sampling SOP #ISSI-VBI70-06 (Attachment 1). In brief, each type of vegetable that is present at each garden will be sampled. The part of the plant that is consumed will be the only portion of the plant included in each sample. The details for identification and placement of the sample locations within each garden are provided in SOP # ISSI-VBI70-06 (Attachment 1). All sampling personnel will be trained in this procedure in order to ensure replicable samples.

All sampling equipment must be decontaminated before it is used again. Tools used for collecting vegetable samples must be decontaminated between each different type of vegetable collected. Soil sampling equipment must be decontaminated after each composite sample has been collected. Decontamination procedures are described in Section 3.3.3.

3.3.2 Sample Handling and Custody Requirements

Samples must be kept under strict chain-of-custody at all times. Therefore, chain-of-custody forms will be prepared for every sample collected in the field (garden vegetables and soil) immediately following collection of each sample. Sample handling and custody requirements are described in Section 3.9 of the Project Plan.

3.3.3 Decontamination Procedures

Decontamination is defined as physically removing inorganic contaminants and foreign material (e.g., dust, oil, detergent) or altering their chemical character to nonreactive/inert substances. Therefore, decontamination (decon) procedures must be rigorously followed to minimize the potential for cross-contamination of samples. All sampling devices and equipment (e.g., coring tools, shovels, clippers) that are planned for use to collect samples at more that one location must be decontaminated prior to reuse.

All decon procedures shall be performed at a designated decontamination area. This area should be chosen such that environmental factors (e.g., cross-winds, drafts, dust) are minimized. Decon procedures will be performed in accord with the Decontamination Procedures SOP #MK-VBI70-07 (Appendix F of the Project Plan).

3.3.4 Sample Preparation

Vegetables

After each vegetable sample has been washed and containerized in the field, vegetable samples will be submitted under chain-of-custody to an approved laboratory for preparation and analysis. Samples will be homogenized, then oven-dried at the contract laboratory.

Garden Soil

After composite soil samples have been collected, they will be submitted under chain-of-custody for sample preparation. Sample preparation will be performed in accord with the most recent version of the Sample Preparation SOP #MK-VBI70-05 (Appendix F of the Project Plan). In brief, the samples will be well-mixed and then oven-dried at >50°C. Following the drying step, samples will then be sieved and homogenized again.

3.3.5 QA/QC Samples

At the appropriate frequency (See Section 4.0) or as directed by the FQAC, QC samples such as splits or blind standards are inserted into the sample stream. These samples will be logged into the Field QC Sample Logbook (Figures 3-7, 3-8, and 3-9 of the Project Plan) and assigned a sample ID. This logbook is a bound (not a three-ring binder) book maintained by the FQAC. The appropriate sample ID numbers and labels will be checked-out from the FPL.

3.4 Field Documentation

Each sampling team will maintain two forms of field documentation, a three-ring binder containing all field data sheets, and a bound field logbook. Information contained in the field logbook includes the following:

- Sample date
- Sample team ID
- Names of sample team members in attendance
- Weather conditions
- Time sampling begun each day
- Time sampling concluded each day
- Any information that is not limited to a single residence (e.g., deviations to sampling protocols)
- Signature of data logger.

This logbook will be maintained daily during sampling activities. Refer to the Field Documentation SOP # MK-VBI70-05 (Appendix F in the Project Plan) for more details.

Each field team will also carry a three-ring binder that holds the VBI70 Garden Vegetable and Soil Sample Data Sheets (Figure 1). These binders will only contain the paperwork necessary to complete a single day of sampling. One data sheet will be completed for each garden, since the data recorded at each property are applicable to every vegetable and composite soil sample collected at that property. Any deviations from standard protocols or notable events (e.g., rainy weather, etc.) should be entered in the section for "Notes". The field team leader will sign the form when sampling is complete and all data are entered onto the form. The field team will not proceed to the next residence until samples are stored in a cooler and paperwork is complete.

At the end of each day of sampling the field teams will return to the Site Office to check-in samples, paperwork and unused sample labels. Samples will be locked and stored under chain-of-custody until they are forwarded for sample preparation and analysis.

3.4.1 Sample Identification

Every field and QC sample collected during this investigation will be identified with a unique sample identification number (sample ID). The sample ID consists of 3 elements as described below. Complete details about the sample ID are provided in the Sample Identification and Tracking SOP ISSI-VBI70-01 (Appendix F of the Project Plan).

PHASE. All labels will begin with the number "3" to indicate that the sample is derived from the Phase III Field Investigation.

NUMBER. Each label will include a unique identification number. This number will be a 5-digit sequential number starting with "00001" and progressively increasing until the final sample has been collected or tag number "99999" has been reached.

SAMPLE PREPARATION. Samples will be categorized based upon the sample preparation performed. The sample preparation nomenclature may be expanded as needed in the future providing they are approved by the Project Database Manager or designate. Garden sample categories include, but are not limited to the following.

- R Raw sample. Original sample collected during Phase III that is unprocessed (Garden vegetables or soils).
- B Bulk fraction. This sample has been prepared by sieving the sample to < 2 mm and then heating above environmental temperatures (> 50 °C) (Garden soils only).

This type of sample ID is not "self-reading" (the sample location or QC type cannot be interpreted by reading the sample ID) and has been designed so that sample anonymity may be maintained through laboratory analysis.

3.5 Analytical Method Requirements

Arsenic and lead testing will be performed on all garden soil samples using XRF, providing the chosen XRF methodology can achieve the project-required detection limits (See Table 2.1). A method detection limit study for the chosen instrumentation and proficiency tests for all analysts who will work on the VBI70 Phase III project must be provided to USEPA before analysis of any field samples may proceed (See Appendix G of the Project Plan). XRF analysis will be performed in accordance with the XRF Instrument Operation SOP #MK-VBI70-06.(Appendix F of the Project Plan)

4.0 QUALITY ASSURANCE PROJECT PLAN

A complete Quality Assurance Project Plan (QAPP) for the VBI70 Phase III Field Investigation has been prepared in accordance with USEPA guidance documents. This section describes activities that are specific to the residential garden sampling portion of the project, required to ensure that all technical, operational, monitoring and reporting activities are of the highest achievable quality. Because the garden vegetable and soil sampling represents a small component of the Phase III field investigation, the majority of the QA/QC program that is described in the Project Plan applies to this portion of the study as well. Therefore, only the sections of the Phase III QAPP that are specific to the garden sampling activities are described. In all cases, the Project Plan for the Phase III
should be consulted for guidance.

4.1 Quality Control Requirements

The principal objectives of any sampling and analysis program are to obtain accurate and representative environmental samples and to provide valid analytical data. The quality of data will be assessed through the use of QC samples analyzed on a regular basis. Laboratory QC samples will be analyzed as per analytical method protocols to evaluate whether laboratory procedures and analyses have been completed properly. For this portion of the project, the types of QC samples to be analyzed are defined and their role in the production of QC data are discussed in the following sections. In addition to the particular QC requirements identified in the subsequent sections, all analyses must be performed within holding times and must adhere to all procedures as outlined in the appropriate SOPs (Appendix F of the Project Plan).

4.1.1 Field Quality Control Samples

Field QC samples are samples that have been either collected or prepared in the field, and must be blind to the analyst at the field laboratory or fixed-based (contract) laboratory.

Blind Field Split: Blind field split samples are two aliquots of the same sample that have been prepared blind to the analyst only after the original sample has been properly prepared (oven-dried, sieved and homogenized). These samples are submitted blind by the field sample preparation technician to the field or contract laboratory to measure the precision of laboratory preparation and analysis. Blind field splits of garden soil samples only will be submitted at a frequency of 5% of all samples collected (1 field split per 20 investigative samples). Acceptance criteria for blind field splits is described in Section 4.8.1 of the Project Plan.

Field Duplicate: Field duplicate samples are co-located samples that are collected at the site by field sampling personnel. These samples are submitted blind to the field preparation technician and the field (for soil) or contract laboratory (for vegetables) to test both the precision of the analysis and the precision of sample collection. Field duplicates will be collected for garden vegetables at a frequency of 5% of all samples collected (1 field duplicate per 20 investigation samples collected). Acceptance criteria for field duplicates is described in Section 4.8.1 of the Project Plan.

Equipment Blank: An equipment blank is a collection of the rinsate produced from rinsing equipment that has been decontaminated after use with 100-120 mLs of analyte-free deionized water. Equipment blanks must be performed at a frequency of 5% of all decontaminations performed on each type of equipment. Concentrations of target analytes greater than 1 x MDL for most analytes and 5-10 x MDL for laboratory-induced contaminants may suggest that field sampling-induced contamination may have occurred. This sample will be analyzed by a contract laboratory.

Blind Standard: The accuracy of an analytical method is evaluated by analyzing a sample medium fortified with a known concentration of target analytes that has been certified using the preparation and analysis method for that particular sample medium. This sample is submitted to the field or contract laboratory blind at a frequency of about 10% for each level. Two concentration levels of blind standards should be available. Blind standards will be submitted for garden soil samples only, because no standards are available for fresh garden vegetables.

The accuracy requirements will be provided by the certifying laboratory. Recoveries will also be monitored using control charting. Control charting will be performed in accord with standard USEPA protocols and will be used to establish site-specific performance criteria. These samples will be analyzed in both the field laboratory and contract laboratory.

Confirmation Sample: In accord with USEPA guidelines (SW-846 Method 6200), the analytical results measured by the XRF must be confirmed using another methodology (ICP, ICP-MS or GFAA) and performed by an independent contract laboratory. Confirmation analyses will be performed on at least 10% of the garden soil samples. A graphical comparison of the XRF analysis and the corresponding ICP, ICP-MS or GFAA metals analysis should also be prepared. This comparison will include a linear regression and will report the calculated correlation coefficient (r). Control charting will be performed in accord with standard USEPA protocols and will be used to establish site-specific performance criteria.

4.1.2 Laboratory Quality Control Samples

Laboratory QC samples are samples that are prepared at the laboratory and are analyzed along with field samples to monitor the accuracy and precision of the analysis. The laboratory QC samples included in the garden sampling portion of this project are the same as those presented in Section 4.8.2 of the Project Plan. Acceptance criteria and corrective action procedures are presented in Table 4.1. Instrument calibration, assessment and oversight, data validation and useability, final reporting requirements, and reconciliation with data quality objectives are described in Sections 4.10 through 4.15 of the Project Plan.

4.2 Detection Limits

MDLs are defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the true value is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. The PQL is defined as 10 times the standard deviation determined from the MDL study (or often described as 3 times the MDL). A MDL study must be performed for each method utilized in the study in accord with guidance outlined in the 40 CFR Part 136, Appendix B. Results that are below the PQL, but above the MDL will be qualified with a 'B' flag and reported as estimated results.

5.0 REFERENCES

ISSI. 1999. Selection of Chemicals of Potential Human Health Concern at the Vasquez Boulevard and I-70 Site. Memorandum to USEPA. June 18, 1999.

USEPA. 1986. SW-846. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. September 1986 and all revisions.

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USEPA. 1998b. Sampling Analysis Report – Phase II Sampling for Removal Site Assessment. Vasquez Boulevard/Interstate 70 Site. Prepared by URS Operating Services. September 21, 1998.

USEPA. 1998c. USEPA Requirements for Quality Assurance Project Plans for Environmental Data Operations. Draft Interim Final. U.S. Environmental Protection Agency, Quality Assurance Management Staff. USEPA QA/R-5.

USEPA. 1998d. EPA QA/G-9 Guidance for the Data Quality Assessment Process: Practical Methods for Data Analysis. EPA/600/R-96/084. January 1998.

USEPA. 1999. Draft Report for the Vasquez Boulevard and I-70 Site Residential Risk-Based Sampling Stage I Investigation. Prepared by ISSI Consulting Group, Inc. April 1999.

Table 4.1: QC Requirements and Recommended Corrective Action for Metals Analysis in Garden Vegetables and Soil

QC Performed	Minimum Frequency	Acceptance Criteria					Recommended Corrective Action				
		General Requirements (GR) [a]	GFAA Method 7060 & 7421	ICP Method 6010 B	ICP/MS Method 6020	XRF SOP #MK-VBI70-06	General Requirements (GR)	GFAA Method 7000	ICP Method 6010 B	ICP/MS Method 6020	XRF SOP #MK-VBI70-06
Field Duplicate (FD) / Field Splits	1 field duplicate per 20 vegetable samples will be collected.	RPD < 25% or,the absolute difference should not exceed 1 x MDL. A graphical comparison of the original and field duplicate samples should also be prepared. Recoveries will also be monitored using control charting. Control charting will be performed in accord with standard USEPA protocols and will be used to establish site-specific performance criteria. This comparison will include a linear regression and will report the calculated correlation coefficient. R should be >0.9.	See GR	See GR	See GR	See GR	Verify the RPD calculation. If this is correct, determine if matrix interference or heterogeneous samples are factors in the poor RPD. If matrix effects or heterogeneous samples are not observed, reanalyze the method duplicate and associated investigative samples. *If appropriate, re-extract or redigest and reanalyze the method duplicate and associated investigative samples.*	See GR	See GR	See GR	See GR
Blind Standard	10% of all surface soil samples.	Accuracy requirements will be provided by the certifying laboratory. Recoveries will also be monitored using control charting. Control charting will be performed in accord with standard USEPA protocols and will be used to establish site-specific performance criteria.	See GR	See GR	See GR		Verify the percent recovery calculations. If calculations are correct, the RPM will request the analyst to reanalyze the sample. If reanalysis results are still outside of acceptance limits, submit another blind standard immediately into the sample stream to determine if the analysis shows a trend or an isolated event. *Analysis of site samples may be discontinued until the problem is resolved.*	See GR	See GR	See GR	See GR
Blind Field Split (BS)/ Blind Field Duplicate	5% of all garden soil samples. (1 field duplicate per 20)	RPD < 25% or,the absolute difference should not exceed 1 x MDL. A graphical comparison of the original and field duplicate samples should also be prepared. Recoveries will also be monitored using control charting. This comparison will include a linear regression and will report the calculated correlation coefficient. R should be >0.9. Additionally, control charting will be performed in accord with standard USEPA protocols and will be used to establish site-specific performance criteria.	See GR	See GR	See GR	See GR	Verify the RPD calculation. If this is correct, determine if matrix interference or heterogeneous samples are factors in the poor RPD. If matrix effects or heterogeneous samples are not observed, reanalyze the method duplicate and associated investigative samples. *If appropriate, re-extract or redigest and reanalyze the method duplicate and associated investigative samples.*	See GR	See GR	See GR	See GR

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QC Performed	Minimum Frequency	Acceptance Criteria					Recommended Corrective Action				
		General Requirements (GR) "	GFAA Method 7060 & 7421	ICP Method 6010 B	ICP/MS Method 6020	XRF SOP #MK-VBI70-06	General Requirements (GR)	GFAA Method 7000	ICP Method 6010 B	ICP/MS Method 6020	XRF SOP #MK-VBI70-06
Matrix Spike (MS)	5% or 1 per batch (whichever is more frequent)	N/A	80-120% recovery of known value	75-125% spiked sample recovery (spiking level plus original sample level)	75-125% recovery of known value	N/A	Verify the matrix spike percent recovery calculations and evaluate the LCS percent recoveries. If the calculations are correct and the LCS recoveries are acceptable, determine if matrix interference is a factor in the poor recoveries. If matrix effects are not observed, reanalyze the matrix spike and associated investigative samples. *If appropriate, re-extract or redigest and reanalyze the matrix spike and associated investigative samples.*	Interference test must be conducted (see SW 846 Method 7060 and 7421 for description of interference tests).	Locate source of the problem, correct it, and re-analyze any samples that were run during the out-of-control condition.	Locate source of the problem, correct it, and re-analyze any samples that were run during the out-of-control condition.	N/A
Post-digestion Spike (PDS)	as required; if matrix spike does not meet acceptance criteria	N/A	85-115% of known value	85-115% recovery of post spiked sample	75-125% of known value.	N/A	Verify the percent recovery calculations. If these are acceptable and the spike addition produces a minimum level of 10 times to a maximum of 100 times the instrument detection limit (IDL), matrix effects should be suspected. No further action is required.	If recovery <40%, dilute sample by factor of 5-10 and rerun. If after dilution recovery still <40%, report problem to USEPA.	Sample must be diluted and re-analyzed to compensate for possible matrix effects. Results must agree to within 10% of the original determination.	Sample must be diluted and re-analyzed to compensate for possible matrix effects. Results must agree to within 10% of the original determination.	N/A
Laboratory Control Sample (LCS) or Standard Reference Material (SRM)	5% or 1 per batch (whichever is more frequent)	must be within manufacturer's established acceptance limits.	80-120% of known value	See GR	See GR	See GR	Verify the percent recovery calculations. Evaluate the standard to determine if it is faulty. If it is, prepare a new standard and reanalyze the LCS and associated investigative samples. If necessary, recalibrate the instrument. *Do not continue analysis until the problem is solved.*	Re-run the LCS or SRM one time, if still not acceptable, all samples analyzed after the last acceptable LCS must be re-prepped and re-analyzed.	See GR	See GR	See GR
Method Duplicate (MD)	5% or 1 per batch (whichever is more frequent)	RPD < 25% (if 5 x MDL), absolute difference 1 x MDL	See GR	RPD < 25% (if 5 x MDL), absolute difference 1 x MDL	RPD < 25% (if 5 x MDL), absolute difference 1 x MDL	See GR	Verify the RPD calculation. If this is correct, determine if matrix interference or heterogeneous samples is a factor in the poor RPD. If matrix effects or heterogeneous samples are not observed, reanalyze the method duplicate and associated investigative samples. *If appropriate, re-extract or redigest and reanalyze the method duplicate and associated investigative samples.*	See GR	See GR	See GR	See GR

Table 4.1: QC Requirements and Recommended Corrective Action for Metals Analysis in Garden Vegetables and Soil

QC Performed	Minimum Frequency	Acceptance Criteria					Recommended Corrective Action				
		General Requirements (GR) *	GFAA Method 7060 & 7421	ICP Method 6010 B	ICP/MS Method 6020	XRF SOP #MK-VBI70-06	General Requirements (GR)	GFAA Method 7000	ICP Method 6010 B	ICP/MS Method 6020	XRF SOP #MK-VBI70-06
Initial Calibration Verification (ICV)	beginning of each run *and end, after the last analytical sample;* or beginning of every new shift (whichever is more frequent)(after the ICB)	N/A	90-110% recovery of known value	90-110% recovery of known value	90-110% recovery of known value	Follow procedures outlined in operator's manual. 80-120% recovery of known value, regardless of which calibration procedure is used.	Verify the percent recovery calculations. If calculations are correct, evaluate the standard to determine if it is faulty. If it is, prepare a new standard and reanalyze the ICV and all associated investigative samples. If necessary, recalibrate the instrument. *Do not continue analysis until the problem is solved.*	Calibration curves must cover the appropriate concentration range, as determined by Project specifications. Blanks and standards should produce an absorbance of 0.0 - 0.7	Terminate analysis, correct the problem, and recalibrate the instrument. Any sample analyzed under an out-of-control calibration must be re-analyzed.	Terminate analysis, correct the problem, and recalibrate the instrument. Any sample analyzed under an out-of-control calibration must be re-analyzed.	See GR
Initial Calibration Blank (ICB)	beginning of each run or beginning of every new shift (whichever is more frequent)(before the ICV)	N/A	≤ 1 x MDL	< 1 x MDL	< 3 x IDL for each analyte.	N/A	Evaluate system, locate source of contamination, and perform a system blank to determine if the system blank meets acceptance criteria. Perform instrument maintenance until analysis of system blanks meets acceptance criteria. *Do not begin analysis of investigative samples until criteria are met.*	Determine the cause, correct the problem, and recalibrate the instrument before any samples are analyzed.	See GR	See GR	N/A
Continuing Calibration Verification (CCV)	every 10 samples in the analytical batch (after the CCB) For XRF analyses, once per batch of investigative samples.	N/A	90-110% recovery of known value	90-110% recovery of known value	90-110% recovery of known value	80-120% recovery of known value	Verify the percent recovery calculations. If calculations are correct, evaluate the standard to determine if it is faulty. If it is, prepare a new standard and reanalyze the CCV and all associated investigative samples. If necessary, recalibrate the instrument. *Do not continue analysis until the problem is solved. If std > control limits, stop analysis, correct problem, recalibrate instrument, verify calibration, and reanalyze all samples analyzed since the last good CCV.*	Discontinue sample analysis, determine cause of the problem, correct the problem, and recalibrate the instrument.	See GR	See GR	reanalyze check sample; if still not acceptable, recalibrate the instrument. All samples analyzed since the last acceptable CCV must be reanalyzed.

Table 4.1: QC Requirements and Recommended Corrective Action for Metals Analysis in Garden Vegetables and Soil

QC Performed	Minimum Frequency	Acceptance Criteria					Recommended Corrective Action				
		General Requirements (GR) *	GFAA Method 7060 & 7421	ICP Method 6010 B	ICP/MS Method 6020	XRF SOP #MK-VBI70-06	General Requirements (GR)	GFAA Method 7000	ICP Method 6010 B	ICP/MS Method 6020	XRF SOP #MK-VBI70-06
Continuing Calibration Blank (CCB)	every 10 samples in the analytical batch (before the CCV), *or once every 2 hrs. during the analytical run, whichever is more frequent. A CCB must be run after the last CCV after the last sample.*	N/A	≤ 1 x MDL	within 3 x IDL for each analyte	< 3 x IDL for each analyte.	N/A	Evaluate instrument or system, locate source of contamination, and perform a system blank to determine if the system blank meets acceptance criteria. Continue to perform system blanks until acceptance criteria are met. *Reanalyze the blank and associated investigative samples. If the absolute value of the blank exceeds the PQL, correct the problem, recalibrate instrument, verify the calibration, and reanalyze the preceding 10 analytical samples or all of the analytical samples analyzed since the last good calibration blank.*	All samples following the last acceptable CCB must be reanalyzed.	If the average recoveries are not within 3 standard deviations of the background mean, terminate analysis, correct the problem, recalibrate the instrument. Re-analyze the previous 10 investigative samples.	Cause of the problem must be determined, corrected, and all samples analyzed since the last acceptable CCB must be re-analyzed. If a lab consistently has concentration values > 3 x IDL, the IDL may be indicative of an estimated IDL, and must be re-evaluated.	N/A
Energy calibration check		1) Beginning and end of each working day. 2) After batteries are changed. 3) After instrument has been shut off. 4) Any other time when operator believes that drift is occurring.	N/A	N/A	N/A	N/A	Manufacturer's recommended count time should be used for the check: pure elements (Fe, Mn, Cu, Pb) are usually used for this check	N/A	N/A	N/A	Reposition pure element sample and reanalyze. If criteria are still not met, energy calibration must be performed as described in the manufacturer's manual. Do not analyze investigative samples until criteria are met.
Equipment Blank	5% of all decontaminations performed on each type of equipment	target analytes <1 x MDL; 5-10 x MDL for laboratory-induced contaminants	See GR	See GR	See GR	N/A	Suggests that field sampling-induced contamination may have occurred. Evaluate all associated QC samples. If all other QC samples are within prescribed acceptance limits, but the equipment blank is not (e.g., positive identifications of target analytes are observed), *contact the USEPA Immediately to determine whether resampling and/or reanalysis is required.*	See GR	See GR	See GR	N/A
Method Blank (MB)	5% or 1 per batch (whichever is more frequent)	Absolute value < PQL	< 1 x MDL; or 10% of lowest concentration for each analyte.	< 1 x MDL except for common laboratory contaminants which may be 5-10 x MDL. *If any analyte concentration is > PQL, the lowest conc. of that analyte in the associated samples must be 10x more than the conc. found in the blank.*	< 1 x MDL except for common laboratory contaminants which may be 5 10 x MDL. *If any analyte concentration is > PQL, the lowest conc. of that analyte in the associated samples must be 10x more than the conc. found in the blank.*	<MDL for each analyte.	Evaluate instrument, locate source of contamination, perform system blanks to confirm that the system blank meets performance criteria. Re-analyze method blank and associated samples. *If method blank is still above the acceptance criteria, re-extract or redigest the method blank and all associated samples.*	See GR	See GR	See GR	check probe window; blank sample should be checked for contamination. If no contamination is present, the instrument must be zeroed following manufacturer's instructions. Re-analyze all samples since the last acceptable MB.

Table 4.1: QC Requirements and Recommended Corrective Action for Metals Analysis in Garden Vegetables and Soil

QC Performed	Minimum Frequency	Acceptance Criteria					Recommended Corrective Action				
		General Requirements (GR) *	GFAA Method 7060 & 7421	ICP Method 6010 B	ICP/MS Method 6020	XRF SOP #MK-VBI70-06	General Requirements (GR)	GFAA Method 7000	ICP Method 6010 B	ICP/MS Method 6020	XRF SOP #MK-VBI70-06
Instrument Blank (IB)	5% or 1 per batch (whichever is more frequent)	N/A	N/A	N/A	N/A	Follow procedures outlined in operator's manual. 80-120% recovery of known value, regardless of which calibration procedure is used.	Evaluate system, locate source of contamination, and perform a system blank to determine if the system blank meets acceptance criteria. Perform instrument maintenance until analysis of system blanks meet acceptance criteria. *Do not begin analysis of investigative samples until criteria are met.*	N/A	N/A	N/A	check probe window; blank sample should be checked for contamination. If no contamination is present, the instrument must be zeroed following manufacturer's instructions. Re-analyze all samples since the last acceptable IB.
System Blank	as required; if other blank samples are not meeting acceptance criteria	< 1 x MDL	See GR.	See GR	See GR	N/A	Evaluate system, locate source of contamination, and perform a system blank to determine if the system blank meets acceptance criteria. Perform instrument maintenance until analysis of system blanks meet acceptance criteria. *Do not begin analysis of investigative samples until criteria are met.*	See GR	See GR	See GR	N/A

* General Requirements should be followed in all cases, except where the requirements of the method are specified. In those cases, follow general requirements as stated and then refer to specific requirements for each method.

MDL - Method Detection Limit
RPD - Relative Percent Difference
PQL - Practical Quantitation Limit
IDL - Instrument Detection Limit
SRM - Standard Reference Material
N/A - Not Applicable

FIGURE 1

GARDEN VEGETABLE AND SOIL DATA SHEET - page 1

PHASE: 3 **DATE:** _____

SAMPLE COLLECTION METHOD: ISSI-VBI70-06 Revision 0 **TIME:** _____

SAMPLE TEAM ID: _____ **MEDIA:** GS (Garden Soil)

ADDRESS: _____ V (Vegetable)

House#

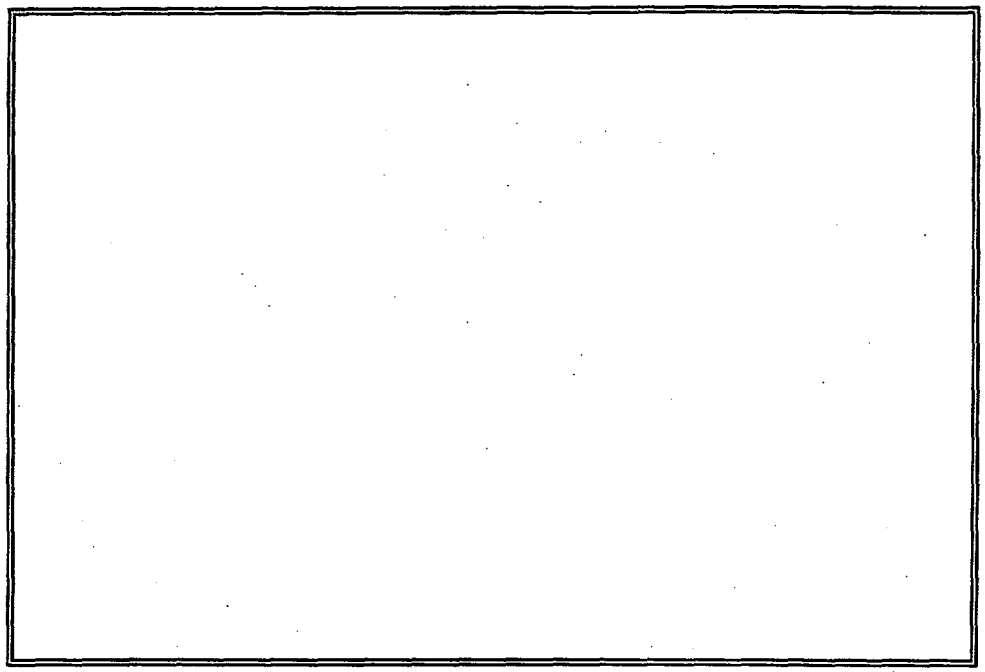
_____

Street Name

SAMPLE TYPE: (circle one)		original sample ID #	VEGETABLE SAMPLE ID LABEL	SOIL SAMPLE ID LABEL	SAMPLE TYPE:
FS	FD		3-#####-R	3-#####-R	COMP
FS	FD		3-#####-R		
FS	FD		3-#####-R		
FS	FD		3-#####-R		
FS	FD		3-#####-R		
FS	FD		3-#####-R		
FS	FD		3-#####-R		
FS	FD		3-#####-R		

FIGURE 1
GARDEN VEGETABLE AND SOIL DATA SHEET - page 2

SITE DIAGRAM



VEGETABLE TYPE (S)

(S) = soil sub-sample
(V) = vegetable sample

CORN (C)	BEANS (BN)
TOMATOES (T)	LETTUCE (L)
SQUASH (SQ)	PEPPER (P)
BEETS (BT)	

Samples Collected By: _____ Date: _____

Logbook Page reviewed By: _____ Date: _____

ATTACHMENT 1

Basic Contract No.: SBAHQ-98-D-0002
Project No.: 96290-ARA-01
Delivery Order No.: 0008
Requisition No.: 9.5770.0175
EPA IAG No.: DW47953681

Date: September 8, 1999 (Rev. # 0) SOP No. ISSI-VBI70-06

Title: GARDEN VEGETABLE SAMPLING AT RESIDENCES FOR DETERMINATION OF RISK-BASED EXPOSURE TO METALS

APPROVALS:

Author ISSI Consulting Group, Inc. Date: September 8, 1999

SYNOPSIS: A standard method for exposure-based residential garden vegetable and soil sampling is described. Protocols for sample collection, compositing, and sample handling are provided.

Received by QA Unit:

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Region 8		
ISSI Consulting Group, Inc.		

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide a standardized method for residential garden vegetable and soil sampling, to be used by employees of USEPA Region 8, or contractors and subcontractors supporting USEPA Region 8 projects and tasks. This SOP describes the equipment and operations used for sampling residential garden vegetables and soils in areas which will produce data that can be used to support risk evaluations. Deviations from the procedures outlined in this document must be approved by the USEPA Region 8 Remedial Project Manager or Regional Toxicologist prior to initiation of the sampling activity.

2.0 RESPONSIBILITIES

The Field Project Leader (FPL) may be an USEPA employee or contractor who is responsible for overseeing the residential garden sampling activities. The FPL is also responsible for checking all work performed and verifying that the work satisfies the specific tasks outlined by this SOP and the Project Plan. It is the responsibility of the FPL to communicate with the Field Personnel regarding specific collection objectives and anticipated situations that require any deviation from the Project Plan. It is also the responsibility of the FPL to communicate the need for any deviations from the Project Plan with the appropriate USEPA Region 8 personnel (Remedial Project Manager or Regional Toxicologist).

Field personnel performing residential garden vegetable and soil sampling are responsible for adhering to the applicable tasks outlined in this procedure while collecting samples. The field personnel should have limited discretion with regard to collection procedures, but should exercise judgment regarding the exact location of the Sample Point, within the boundaries outlined by the FPL.

3.0 EQUIPMENT

- Soil augers - Various models of soil augers are acceptable and selection of the specific brand and make of tool is at the discretion of the contractor implementing the field work. Augers are usually made of stainless steel, and should be capable of retrieving a cylindrical plug of soil 2 inches in diameter and 6 inches in depth. In all cases, the procedures recommended by the manufacturer should be followed with regard to use of the auger. Augers with disposable plastic sleeves may be employed to minimize the decontamination effort.

- Collection containers - plastic ziplock bags (gallon-size capacity).

- Shovel - for collecting root vegetables. Must be lead free and unpainted.

- Trowel - for extruding the soil from the auger; for digging up plants. May be plastic or stainless steel.

- Gloves - for personal protection and to prevent cross-contamination of samples. May be plastic or latex. Disposable, powderless.

- Squeeze Bottle - for dispensing deionized water. Used to clean and decontaminate sampling equipment. Must be labeled "DI Water".

- Squeeze bottle -for dispensing potable (drinking) quality water. Used to clean and decontaminate sampling equipment. Must be labeled "TapWater".

- Deionized Water - for rinsing vegetable samples.

- Plastic Buckets - used to rinse vegetables, and to receive rinse water generated in the course of tool cleaning.

- Vegetable Brush - used to scrub soil from root vegetables.

- Wipes - disposable, paper or baby wipes. Used to clean and decontaminate sampling equipment.

- Clippers - for cutting samples from plants.

- Laboratory Surfactant - used to decontaminate sampling equipment. Alconox is a brand in common use.

- Field clothing and Personal Protective Equipment - as specified in the Health and Safety Plan.

- Field notebook - a bound book used to record progress of sampling effort and record any problems and field observations during sampling.

- Three-ring binder book- to store necessary forms used to record and track samples collected at the site. Binders will contain the Garden Vegetable and Soil Data Sheet, Site Diagram, and sample labels. Example forms are provided in Attachment 1.

- Permanent marking pen - used as needed during sampling and for documentation of field logbooks and data sheets.

- Measuring tape or wheel - used to measure each garden.

- Measuring tape or pocket ruler - used to measure the length of soil core in the soil coring device.

- Trash Bag - used to dispose of gloves and wipes.

4.0 SAMPLING PATTERN

At each garden selected for sampling, one sample of each type of vegetable and one composite sample of garden soil will be collected as detailed below.

4.1 Sample labeling and Field Data Sheet

Using a measuring wheel or measuring tape, measure the dimensions of the garden. If there are no clear boundaries of the garden, measure to about six inches from the end of each row or cluster of plants.

Prepare a diagram of the garden using the Garden Vegetable and Soil Data Sheet (Attachment 1). Indicate the location of different types of crops within the garden, as well as any anomalies in soil color, soil texture, or any noticeable differences among the plants (i.e., one side or patch of the garden is dead). As a time saving mechanism, a coding system may be used on the site diagram (c = corn, t = tomato, etc.), but the coding definition **must be indicated** in the plant type section of the form (see Attachment 1). Abbreviations must be standardized across sampling teams. Therefore, if a field team encounters a vegetable for which there is no established code, the team should immediately call the FPL for a recommendation. Record the locations of vegetable and soil samples collected from the garden, using a circled 'v' for vegetable samples and a circled 's' for soil sub-samples. Follow the collection procedures as detailed below.

5.0 COLLECTION OF LEAFY VEGETABLES

Leafy-type vegetables include crops such as lettuce, cabbage, beet greens, turnip greens, spinach, rhubarb, parsley, and cilantro. Each new vegetable is considered a new sample. A clean pair of gloves should be worn at all times and changed before each different sample is collected. Select one or more plants to collect for the sample, and mark the location of those plants on the site diagram. The minimum amount that must be collected is 200 g (wet weight). Sample weight can be determined by the use of a balance, or it can be estimated using an object that is known to be approximately 200g, and comparing the sample weight to the weight of that object. It is not necessary to weigh the sample to precisely 100g.

Harvest the plant as it would be in a commercial garden. In the case of lettuce, cut the entire plant at ground level. In the case of beet greens, if the root is not to be analyzed, the leaves may be cut from the plant leaving the beet root in the ground. Using a clean plastic bucket that has been partially filled with deionized water, immerse the sampled plant material in deionized water and wash the dust and soil from the plant using gentle agitation for one minute. Drain the water from the plant and place the entire sample in a plastic ziplock bag that has been properly labeled. Place the sample immediately in a secured cooler at a temperature of 4° C. If the sample is too large to fit securely in the bag, remove a small portion, and dispose of the excess material according to SOP #MK-VBI70-04. Do not force the sample into the bag, as this may result in the bag opening during transport.

Follow the decontamination procedure described in Section 10.0 to decontaminate any equipment that was used. Remove gloves and place in the trash bag for disposal.

6.0 COLLECTION OF ROOT VEGETABLES

Root-type vegetables include crops such as radishes, turnips, carrots, potatoes, beets, parsnips, rutabegas, kohlrabi, jerusalem artichoke, onion, sweetpotatoes, and leeks. A clean pair of gloves should be worn at all times and changed before each sample is collected. Harvest the plant as it would be in a commercial garden. Select one or more plants to collect for the sample, and mark the location of those plants on the diagram. The minimum amount that must be collected is 200 g (wet weight). Sample weight can be determined by the use of a balance, or it can be estimated using an object that is known to be approximately 200g, and comparing the sample weight to the weight of that object. It is not necessary to weigh the sample to precisely 200g.

Using the shovel, dig a circle around the base of the plant, then dig up the entire plant, gently removing it from the soil. Bring up the entire shovel-full of earth and plant material, and shake the plant free from the earth mass. Shake off as much soil from the root as possible, then use the clippers to cut off the top of the plant. Do not cut the top of the root portion of the plant. If the top of the plant is being sampled (beet greens, turnip greens, etc.), follow the procedures in Section 5.0 and prepare this portion of the sample before preparing the root portion. The green tops of the plant should be removed before washing.

Roots should be washed by repeatedly immersing them in a bucket of deionized water and scrubbing the taproot surface with a brush. Change the water in the bucket if it becomes muddy. The roots should have no visible soil adhering to the surface. After scrubbing, roots should be given a final rinse in a bucket of deionized water, placed in a labeled plastic bag, and stored in a secure cooler at 4° C.

Garden soil excavated as part of root vegetable sampling should be replaced and the surface lightly tamped down. Vegetable material not to be analyzed but generated as part of the sampling effort (carrot greens for example) should be disposed according to SOP #MK-VBI70-04.

Follow the decontamination procedure described in Section 10.0 to decontaminate any equipment that was used. Remove gloves and place in the trash bag for disposal.

7.0 COLLECTION OF GARDEN FRUITS

Fruit-type vegetables include crops such as peppers, tomatoes, zucchini, yellow squash, summer squash, okra, cucumbers, broccoli, cauliflower, eggplant, snowpeas, yellow wax beans, green beans, corn, celery, asparagus, brussels sprouts, and artichokes. A clean pair of gloves should be worn at all times and changed before each sample is collected. Harvest the plant as it would be in a commercial garden. Select one or more plants to collect for the sample, and mark the location of those plants on the site diagram. The minimum amount that must be collected is 200 g (wet weight). Sample weight can be determined by the use of a balance, or it can be estimated using an object that is known to be approximately 200g, and comparing the sample weight to the weight of that object. It is not necessary to weigh the sample to precisely 200g.

In the case of tomatoes, the fruit may be pulled directly from the vine using a gloved hand. It may be necessary to use decontaminated clippers to cut the tomato fruit from the plant. Rinse the tomatoes by immersing them in a bucket partially filled with deionized water and wipe them while under water to remove any visible soil. Place the fruits in a new appropriately labeled ziplock bag and store in a cooler at 4° C.

In the case of corn, samples should be prepared by removing the edible portion, and placing it directly inside the sample container. Begin by removing the corn husk from the ear, and then immerse the ear in a clean plastic bucket partially filled with deionized water. Gently agitate for one minute. Shake off the excess water, and cut the kernels from the cob, using a clean knife. Hold the ear so that the corn kernels fall directly into the sample container. Husks, the cleaned cob, and kernels that fell outside of the bag should be disposed according to SOP #MK-VBI70-04.

Follow the decontamination procedure described in Section 10.0 to decontaminate any equipment that was used. Remove gloves and place in the trash bag for disposal.

8.0 COLLECTION OF GARDEN SOIL

Residential garden soil samples will be composited, which requires soil collection from multiple (sub-sample) points. These soils are then mixed and used as a measure of the

concentration averaged over the entire area (garden). Surficial soil samples (0-6 inch depth) will be collected.

The surficial sampling locations identified within a garden will be based on the collection of vegetable samples. At each vegetable sample location, a corresponding soil sub-sample will be collected. An independent chemical analysis will not be performed for each of the sub-samples collected from each garden, because the goal is to determine the overall concentration in the soil in which the vegetables are grown. Rather, one composite sample will be collected per garden, consisting of between 3-8 sub-samples.

Before collecting any samples, mark the location of each sub-sample on the site diagram, using a circled 's' (see Attachment 2). Sub-samples should be located as close as possible to the plant(s) being sampled. A minimum of three and a maximum of eight sub-samples should be included in the composite for each garden. In gardens with less than three sampled plants, sub-samples should be collected in an area that is surrounded by vegetables. Any anomalies in soil color, texture, or plant appearance (i.e., dead or discolored plants) must be recorded on the Garden Vegetable and Soil Data Sheet.

Use a new pair of gloves to collect the soil sample. New gloves do not have to be worn for each sub-sample, since they will be composited in the same ziplock bag.

Place the soil coring tool on the ground and position it vertically. Holding the tool handle with both hands, apply pressure sufficient to drive the tool approximately six inches into the ground while applying a slight twisting force to the coring tool. Remove the tool by pulling up on the handle while simultaneously applying a twisting force. If the sample was retrieved successfully, a plug of soil approximately six inches long should have been removed with the coring tool.

Hold the soil coring tool horizontally or place it on the ground. Using a clean spatula or knife, remove the soil collected at depth greater than six inches from the end of the sampling tool. Allow this soil to fall back into the garden. Use a trowel to extrude the soil from the auger, pushing the six-inch soil plug from the coring tool so that it falls directly into the sample container. Repeat the steps outlined above until all of the sub-samples have been collected.

Sample preparation homogenization will be performed in accord with the Sample Preparation SOP (#MK-VBI70-05).

If sampling equipment is to be re-used, follow the decon procedures outlined in Section 10.0 before collecting the next composite sample.

9.0 RECORD KEEPING AND QUALITY CONTROL

Each field crew will carry a three-ring binder book that contains the Garden Vegetable and Soil Data Sheet, and sample labels. In addition, a field notebook should be maintained by each individual or team that is collecting samples, as described in the Project Plan. At the end of each day, the field crews will submit the site sketches and data sheets to the FPL. Each sampled garden must have site sketches with vegetable sample locations, soil sub-sample locations, and sample ID labels, as described in SOP #ISSI-VBI70-01. Deviations from this sampling plan should be noted in the field notebook, as necessary.

For each property, the notebook information must include:

a. date
b. time
c. personnel
d. weather conditions
e. sample identification numbers that were used
f. locations of any samples and sub-samples that could not be collected, and the reason for the deviation
g. descriptions of any deviations to the Residential Garden Vegetable Sampling Plan and the reason for the deviation.

Samples taken from soils with visible staining or other indications of non-homogeneous conditions should also be noted.

As specified in the Sampling Plan, at various points in the sampling effort field personnel should expect to collect quality control samples. These may include filling two sample containers with soils that have been taken from the same garden. It may also include filling two sample containers with the same type of vegetable.

10.0 DECONTAMINATION

After each type of sample is collected, and at the end of each day's sample collection work, all tools must have visible soil removed, be washed with drinking water and laboratory surfactant (Alconox), and triple rinsed with deionized water, as described in SOP #MK-VBI70-07. Wipes, gloves, rinse solutions, and excess plant material must be disposed or stored properly as specified in SOP #MK-VBI70-04.

11.0 SAMPLE TRANSPORT

After collecting all of the samples, check to make sure that each sample label ID number matches the ID number on the Data Sheet. Samples must be transported to the laboratory at

the end of each day, on wet ice (4°C). Samples should be packed so as to minimize degradation of plant material (e.g., soil samples should be not be packed on top of leafy samples). Chain-of-custody (COC) forms must be included in each cooler. Forms should be sealed inside a plastic bag to protect against possible water damage during transport. COC procedures are described in the SOP #MK-VBI70-02.

Logbook DCN _____

ATTACHMENT 1

GARDEN VEGETABLE AND SOIL DATA SHEET - page 1

PHASE: 3 DATE: _____

SAMPLE COLLECTION METHOD: ISSI-VBI70-06 Revision 0 TIME: _____

SAMPLE TEAM ID: _____ MEDIA: GS (Garden Soil)

ADDRESS: _____ V (Vegetable)

House#

_____

Street Name

SAMPLE TYPE: (circle one)		original sample ID #	VEGETABLE SAMPLE ID LABEL	SOIL SAMPLE ID LABEL	SAMPLE TYPE:
FS	FD		3-#####-R	3-#####-R	COMP
FS	FD		3-#####-R		
FS	FD		3-#####-R		
FS	FD		3-#####-R		
FS	FD		3-#####-R		
FS	FD		3-#####-R		
FS	FD		3-#####-R		
FS	FD		3-#####-R		
FS	FD		3-#####-R		

ATTACHMENT 1 Logbook DCN _____

GARDEN VEGETABLE AND SOIL DATA SHEET - page 2

SITE DIAGRAM

VEGETABLE TYPE (S)

○ = soil sub-sample

(V) = vegetable sample

CORN (C) _____	BEANS (BN) _____
TOMATOES (T) _____	LETTUCE (L) _____
SQUASH (SQ) _____	PEPPER (P) _____
BEETS (BT) _____	_____
_____	_____

Samples Collected By: _____ Date: _____

Logbook Page reviewed By: _____ Date: _____

ATTACHMENT 2

Basic Contract No.: SBAHQ-98-D-0002
Project No.: 96290-ARA-01
Delivery Order No.: 0008
Requisition No.: 9.5770.0175
EPA IAG No.: DW47953681